

## Claims

1. An information processing apparatus that serves as a reproduction instruction apparatus for transmitting a data reproduction process request to a node connected to a network and executing a data reproduction process based on return data, characterized by comprising:

a data transmission rate setting unit for selecting one or more data transmission modes to be adopted as a return data transmission mode, from a plurality of data transmission modes, and determining a data transmission rate of each selected data transmission mode;

a packet generating unit for performing a setting process for reproduction request process object data and an address setting process in accordance with the data transmission rate determined by the data transmission rate setting unit, and generating a data reproduction process request packet storing designation data for the set reproduction request process object data as a request statement; and

a network interface unit for transmitting the packet generated by the packet generating unit.

2. The information processing apparatus according to claim 1, characterized in that:

the data transmission rate setting unit is configured to set the data transmission mode in accordance with a demand level of reproduction object data and determine the data transmission rate of each selected data transmission mode.

3. The information processing apparatus according to claim

1, characterized in that:

the data transmission rate setting unit is configured to select the data transmission mode including at least either a carousel transmission mode, a chaining transmission mode, a distributed cache mode or a client server mode, and determine the data transmission rate of each selected mode.

4. The information processing apparatus according to claim 1, characterized in that:

the data transmission rate setting unit is configured to have correspondence data between the demand level of the reproduction object data and a band rate as the data transmission rate of an adopted data transmission mode, select the data transmission mode based upon demand level information of the reproduction object data in accordance with the correspondence data, and execute a process of determining the data transmission rate of each selected mode.

5. The information processing apparatus according to claim 1, characterized in that:

the data transmission rate setting unit is configured to execute a process of determining the data transmission rate of each data transmission mode in accordance with the value of a demand level:  $x$  determined by demand information by adopting a function group:  $y = D_n(x)$  (where  $\sum D_n(x) = 1$ ) set by the demand level:  $x$ , a band rate:  $y$  for each transmission mode and an identification value:  $n$  of each data transmission mode.

6. The information processing apparatus according to claim 1, characterized in that:

the data transmission rate setting unit is configured to execute a process of setting the carousel transmission mode as the adopted data transmission mode, if the demand level of the reproduction object data is higher than a preset threshold value.

7. The information processing apparatus according to claim 1, characterized by further comprising:

a data recovery processing unit for executing a deinterleave process and an FEC decoding process;

wherein the data recovery processing unit is configured to execute the deinterleave process and the FEC decoding process for the reproduction object data extracted from packets received from the node received the data reproduction process request, to recover data.

8. The information processing apparatus according to claim 1, characterized by further comprising:

a rule judgment condition setting unit for setting judgment data capable of being adopted by a process of judging whether a node received the data reproduction process request executes a process satisfying the process request;

wherein the packet generating unit is configured to generate the data reproduction process request packet storing the judgment data set by the rule judgment condition setting unit and the designation data for the reproduction process object data.

9. The information processing apparatus according to claim 8, characterized in that:

the rule judgment condition setting unit is configured to execute a process of setting a probability value:  $\beta$  as a reproduction rule judgment condition statement capable of being adopted by the process of judging whether the node received the data reproduction process request executes the process satisfying the process request;

wherein the packet generating unit is configured to generate a packet storing the probability value:  $\beta$  as the reproduction rule judgment condition statement.

10. The information processing apparatus according to claim 8, characterized in that:

the reproduction object data stored at the node is encoded data at an encoding rate of  $q/p$  converted from  $p$  blocks of divided data into  $q$  blocks by FEC encoding; and

the rule judgment condition setting unit is configured to set a probability value:  $\beta$  indicating that the node received the data reproduction process request returns data at a return probability:  $\beta$ , the probability value:  $\beta$  being set in such a way that the relation, between the number of return blocks:  $q \times \alpha \times n \times \beta$  able to be calculated from the record probability:  $\alpha$  designated by a record instruction apparatus connected to the network, the number of encoded blocks:  $q$  and the number of network-connected nodes:  $n$  and the number of blocks:  $p$ , satisfies the number of return blocks:  $q \times \alpha \times n \times \beta >$  the number of blocks:  $p$ .

11. An information processing apparatus that serves as a demand information provider apparatus for providing demand level information of transmission data over a network,

characterized by comprising:

a communication unit for data transmission and reception to and from a network-connected node; and

5 a control unit for counting the number of demand level information acquisition requests received from the network-connected node via the communication unit and generating demand level information for each data in accordance with the count information, generating response information corresponding to the demand level information acquisition  
10 request in accordance with the generated demand level information, and transmitting the response information via the communication unit.

12. The information processing apparatus according to claim  
15 11, characterized in that:

the control unit is configured to execute transmission control of a carousel transmission process request for data corresponding to the demand level equal to or larger than the threshold value, relative to a carousel transmission execution  
20 node if the demand level for each data based upon the count information becomes equal to or larger than a preset threshold value.

13. The information processing apparatus according to claim  
25 12, characterized in that:

the control unit is configured to execute a process of storing an identifier of carousel transmission execution object data and carousel transmission destination address information set in accordance with transmission source node address  
30 information of the received demand level information

acquisition request, in the carousel transmission process request.

14. An information processing method for a reproduction instruction apparatus for transmitting a data reproduction process request to a node connected to a network and executing a data reproduction process based on return data, characterized by comprising:

a data transmission rate setting step of selecting one or more data transmission modes to be adopted as a return data transmission mode, from a plurality of data transmission modes, and determining a data transmission rate of each selected data transmission mode;

a packet generating step of performing a setting process for reproduction request process object data and an address setting process in accordance with the data transmission rate determined by the data transmission rate setting step, and generating a data reproduction process request packet storing designation data for the set reproduction request process object data as a request statement; and

a packet transmission step for transmitting the packet generated by the packet generating step.

15. The information processing method according to claim 14, characterized in that:

the data transmission rate setting step includes a process of setting the data transmission mode in accordance with a demand level of reproduction object data and determining the data transmission rate of each selected data transmission mode.

16. The information processing method according to claim 14, characterized in that:

the data transmission rate setting unit includes a process of selecting the data transmission mode including at least either a carousel transmission mode, a chaining transmission mode, a distributed cache mode or a client server mode, and determining the data transmission rate of each selected mode.

10 17. The information processing method according to claim 14, characterized in that:

the data transmission rate setting step executes a process of selecting the data transmission mode based upon demand level information of the reproduction object data and determining the data transmission rate of each selected mode, in accordance with correspondence data between the demand level of the reproduction object data and a band rate as the data transmission rate of an adopted data transmission mode.

20 18. The information processing method according to claim 14, characterized in that:

the data transmission rate setting step executes a process of determining the data transmission rate of each data transmission mode in accordance with the value of a demand level:  $x$  determined by demand information by adopting a function group:  $y = D_n(x)$  (where  $\sum D_n(x) = 1$ ) set by the demand level:  $x$ , a band rate:  $y$  for each transmission mode and an identification value:  $n$  of each data transmission mode.

30 19. The information processing method according to claim 14,

characterized in that:

the data transmission rate setting step executes a process of setting the carousel transmission mode as the adopted data transmission mode if the demand level of the reproduction  
5 object data is higher than a preset threshold value.

20. The information processing method according to claim 14, characterized by further comprising:

a data recovery processing step of executing a  
10 deinterleave process and an FEC decoding process;

wherein the data recovery processing step executes the deinterleave process and the FEC decoding process for the reproduction object data extracted from packets received from the node received the data reproduction process request, to  
15 recover data.

21. The information processing method according to claim 14, characterized by further comprising:

a rule judgment condition setting step of setting  
20 judgment data capable of being adopted by a process of judging whether a node received the data reproduction process request executes a process satisfying the process request;

wherein the packet generating step generates the data reproduction process request packet storing the judgment data  
25 set by the rule judgment condition setting step and the designation data for the reproduction process object data.

22. The information processing method according to claim 21, characterized in that:

30 the rule judgment condition setting is configured to



execute a process of setting a probability value:  $\beta$  as a reproduction rule judgment condition statement capable of being adopted by the process of judging whether the node received the data reproduction process request executes the process satisfying the process request;

wherein the packet generating step generates a packet storing the probability value:  $\beta$  as the reproduction rule judgment condition statement.

23. The information processing method according to claim 21, characterized in that:

the reproduction object data stored at the node is encoded data at an encoding rate of  $q/p$  converted from  $p$  blocks of divided data into  $q$  blocks by FEC encoding;

the rule judgment condition setting step sets a probability value:  $\beta$  indicating that the node received the data reproduction process request returns data at a return probability:  $\beta$ , and the probability value:  $\beta$  being set in such a way that the relation, between the number of return blocks:  $q \times \alpha \times n \times \beta$  able to be calculated from the record probability:  $\alpha$  designated by a record instruction apparatus connected to the network, the number of encoded blocks:  $q$  and the number of network-connected nodes:  $n$  and the number of blocks:  $p$ , satisfies the number of return blocks:  $q \times \alpha \times n \times \beta > \text{the number of blocks: } p$ .

24. An information processing method for a demand information provider apparatus for providing demand level information of transmission data over a network, characterized by comprising the steps of:

receiving a demand level information acquisition request  
from a network-connected node via a communication unit;

counting the number of demand level information  
acquisition requests and generating demand level information  
5 for each data in accordance with the count information; and

generating a packet storing the demand level information  
based on the count information as response information and  
transmitting the packet via the communication unit.

10 25. The information processing method according to claim 24,  
characterized by further comprising a step of:

executing transmission control of a carousel  
transmission process request for data corresponding to the  
demand level equal to or larger than the threshold value,  
15 relative to a carousel transmission execution node if the demand  
level for each data based upon the count information becomes  
equal to or larger than a preset threshold value.

20 26. The information processing method according to claim 25,  
characterized by further comprising the step of:

executing a process of storing an identifier of carousel  
transmission execution object data and carousel transmission  
destination address information set in accordance with  
transmission source node address information of the received  
25 demand level information acquisition request, in the carousel  
transmission process request.

27. A computer program for executing a process of  
transmitting a data reproduction process request to a node  
30 connected to a network and executing a data reproduction process

based on return data, characterized by comprising:

5 a data transmission rate setting step of selecting one or more data transmission modes to be adopted as a return data transmission mode, from a plurality of data transmission modes, and determining a data transmission rate of each selected data transmission mode;

10 a packet generating step of performing a setting process for reproduction request process object data and an address setting process in accordance with the data transmission rate determined by the data transmission rate setting step, and generating a data reproduction process request packet storing designation data for the set reproduction request process object data as a request statement; and

15 a packet transmission step for transmitting the packet generated by the packet generating step.

28. A computer program for executing a process of providing demand level information of transmission data over a network, characterized by comprising the steps of:

20 receiving a demand level information acquisition request from a network-connected node via a communication unit;

counting the number of demand level information acquisition requests and generating demand level information for each data in accordance with the count information; and

25 generating a packet storing the demand level information based on the count information as response information and transmitting the packet via the communication unit.